

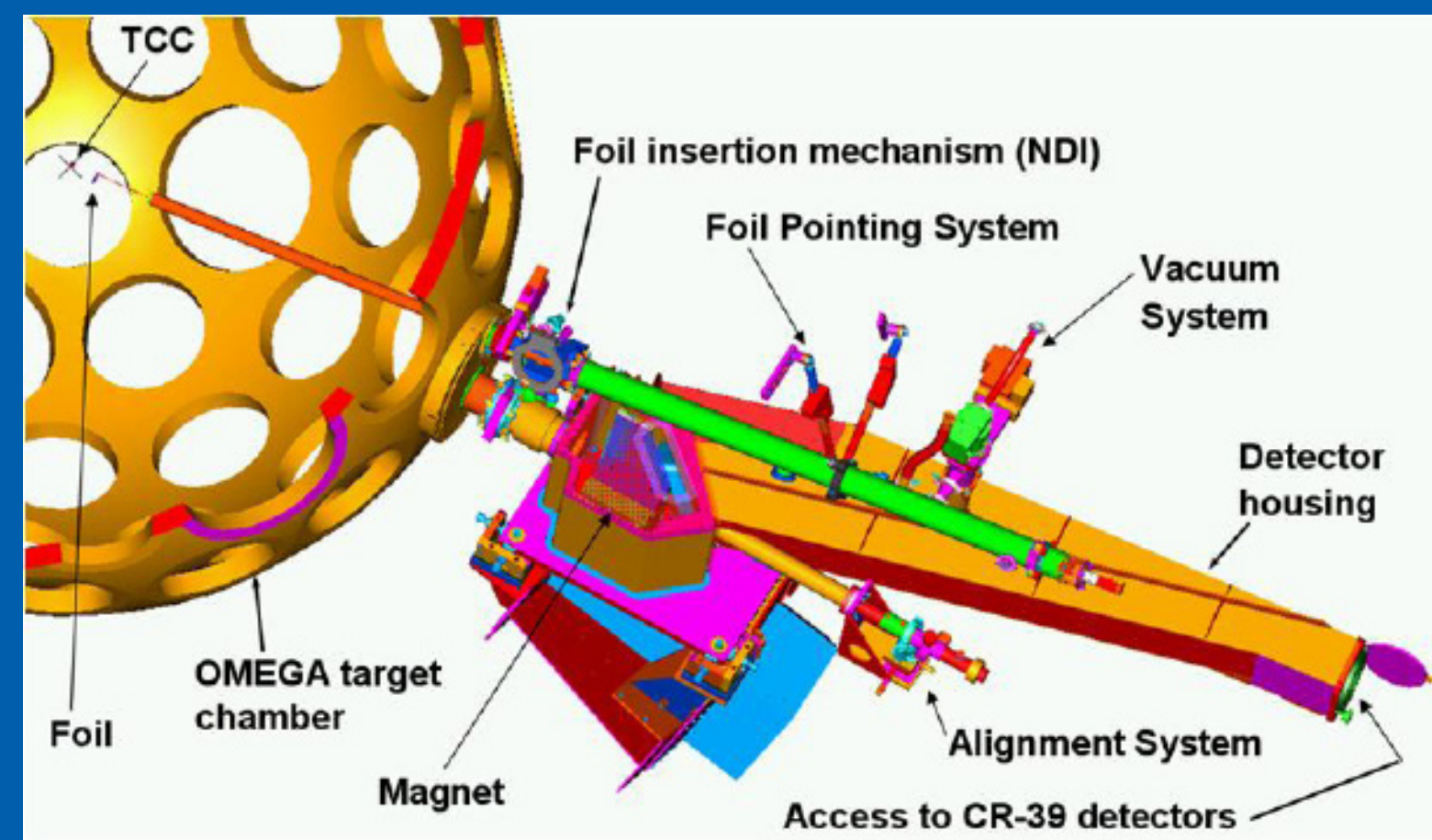


Preparation of Deuterated Polymer Targets for the OMEGA Magnetic Recoil Spectrometer

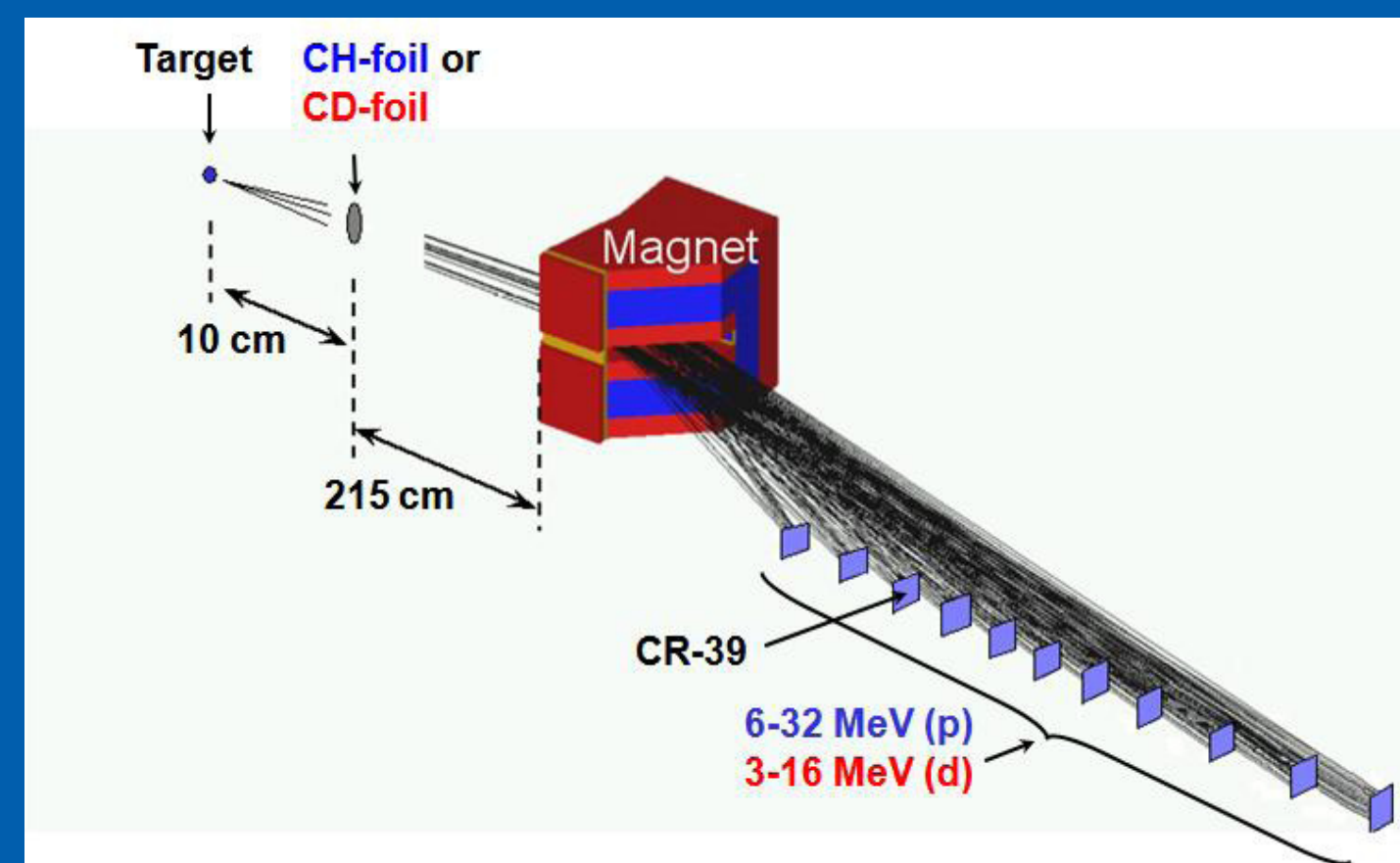
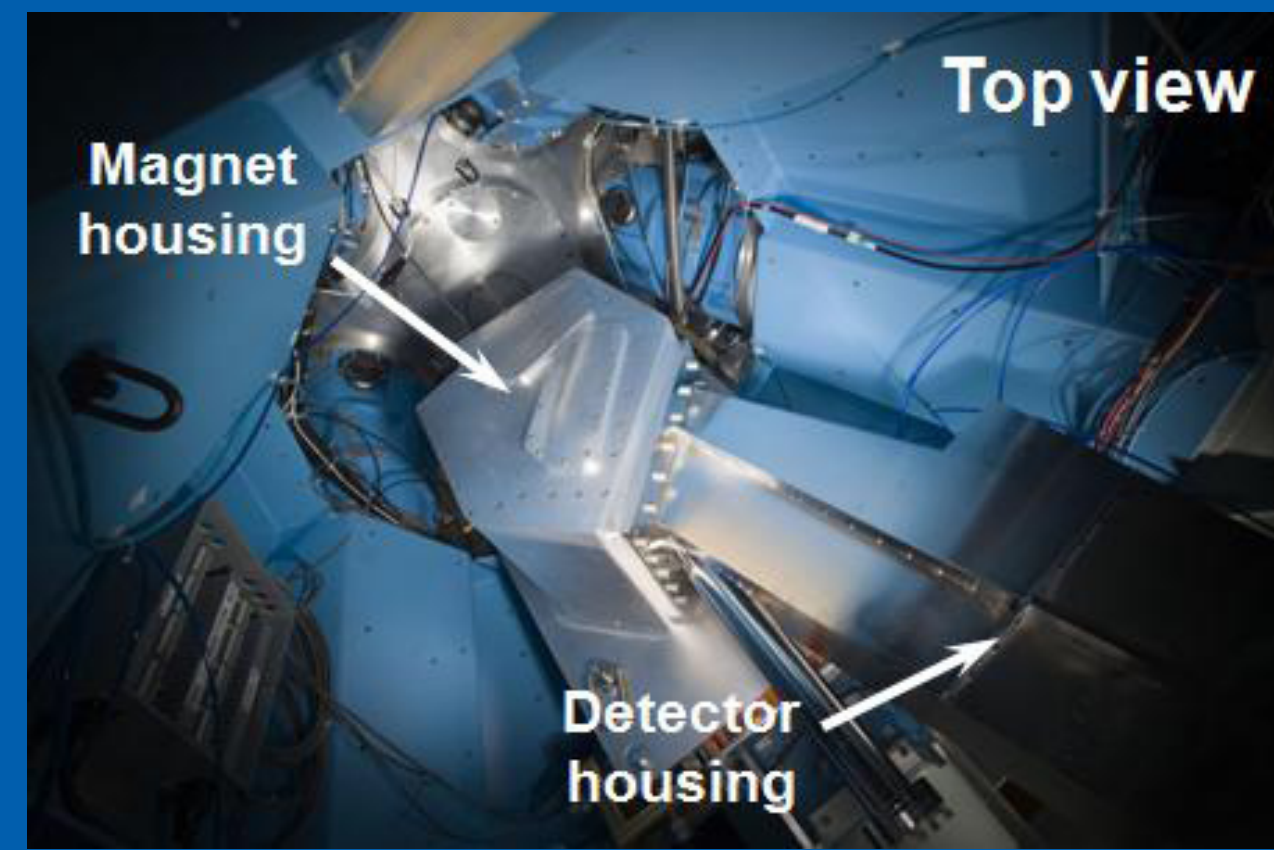
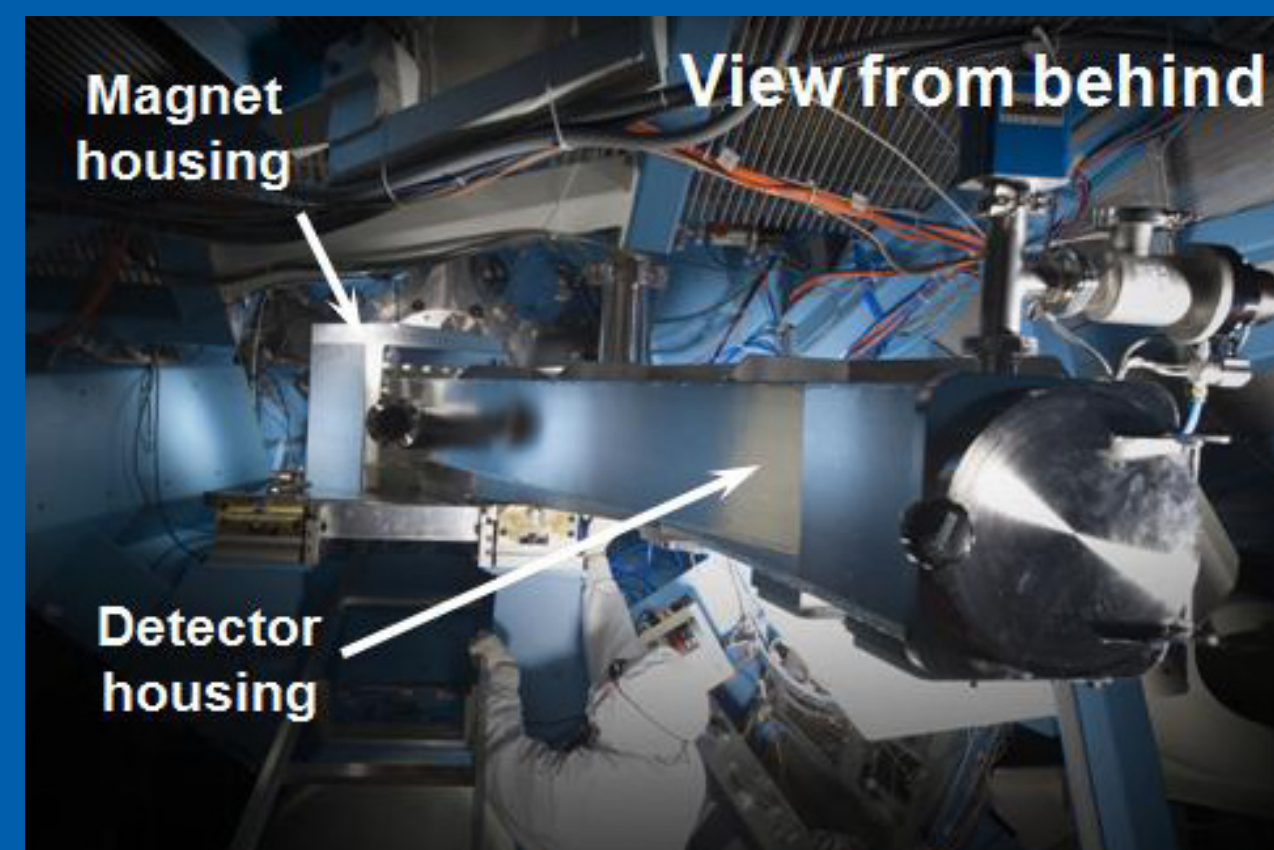


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MRS at OMEGA



The MRS is designed to measure the neutron energy spectrum produced in ICF implosions at OMEGA and the National Ignition Facility (NIF).



Neutrons produced in ICF reactions will strike the deuterated polymer film, scattering the deuterium nuclei into the magnetic spectrometer. The energy of the scattered deuterons will be used to infer the neutron energy spectrum.

Objective

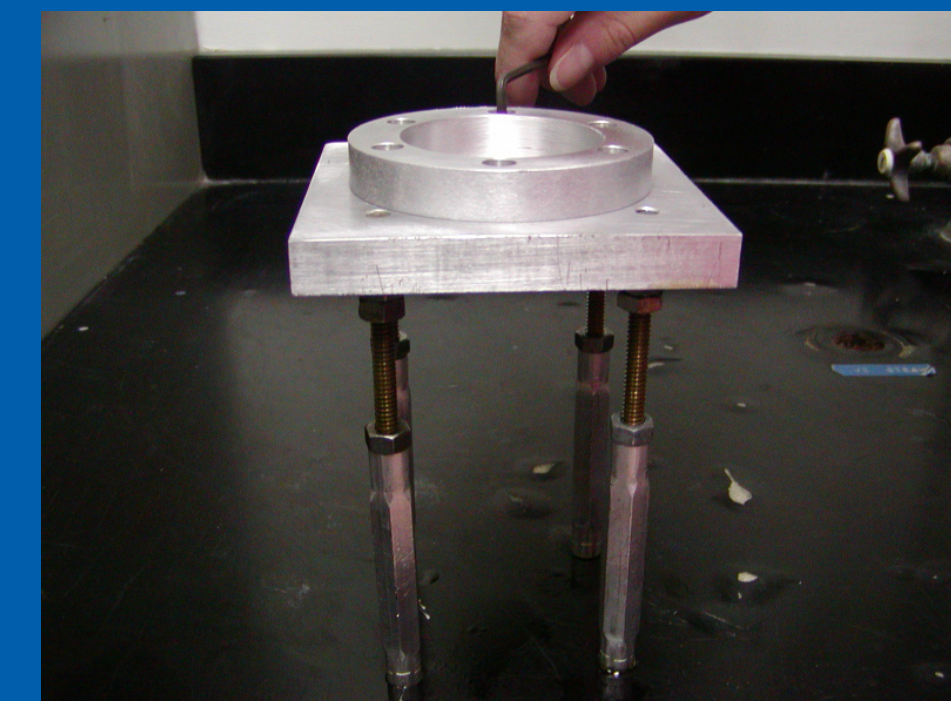
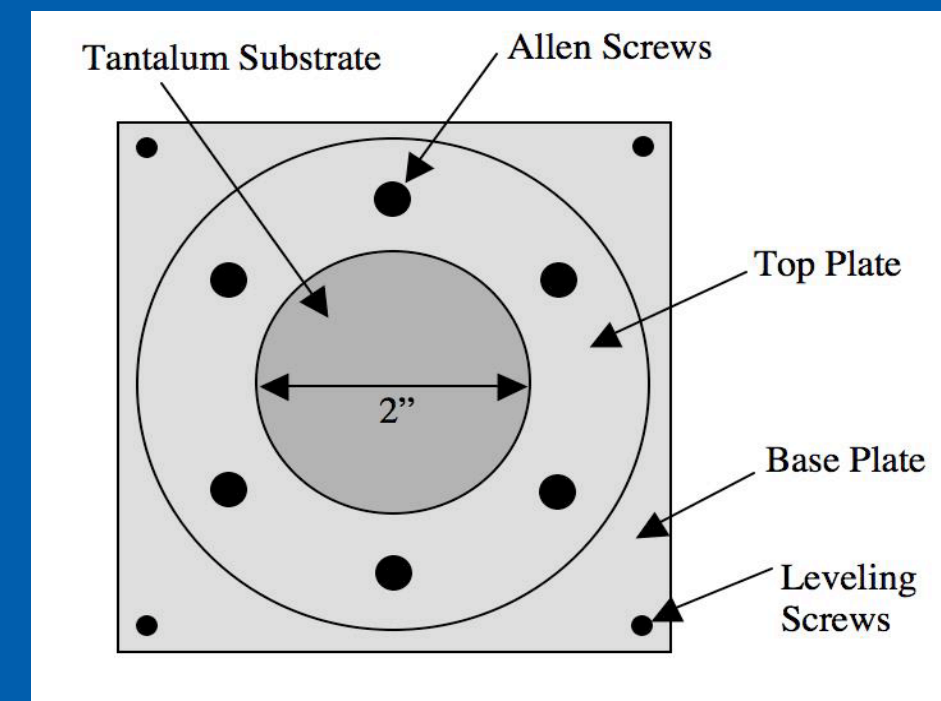
To prepare uniform deuterated polyethylene (DPE) films on tantalum substrates, to be used as by the Magnetic Recoil Spectrometer (MRS) experiments at the OMEGA laser system located at the University of Rochester's Laboratory for Laser Energetics (LLE).

The polymer thicknesses are to be characterized to within 5% with less than 5% variation throughout the sample.

Area (cm ²)	Diameter (cm)	Thickness (μm)
2.0	1.6	40
5.0	2.5	60
8.0	3.2	80
13.0	4.1	130
13.0	4.1	190
13.0	4.1	290
13.0	4.1	390

Procedure

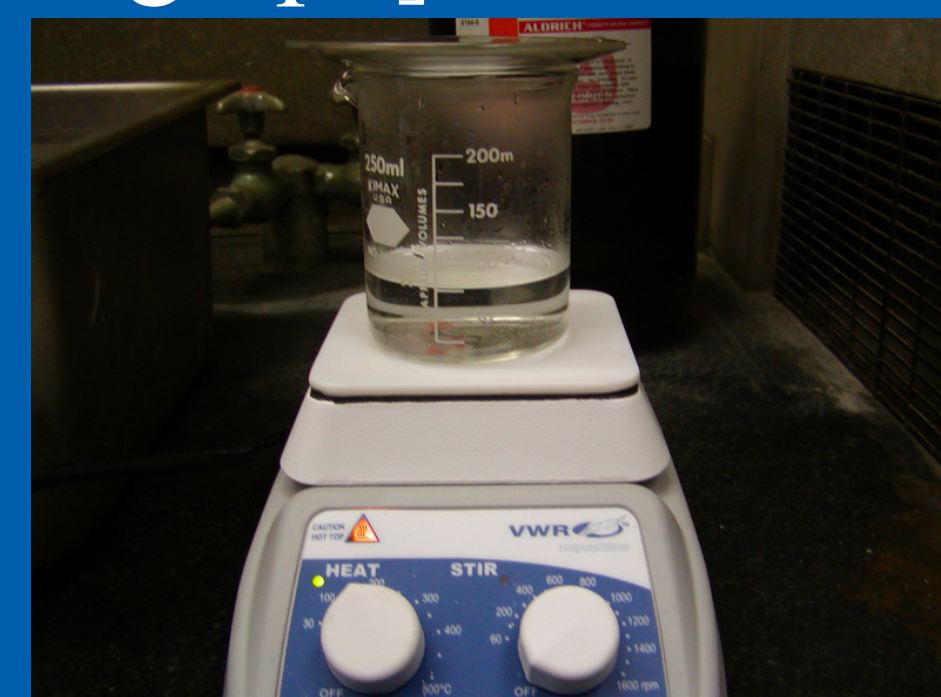
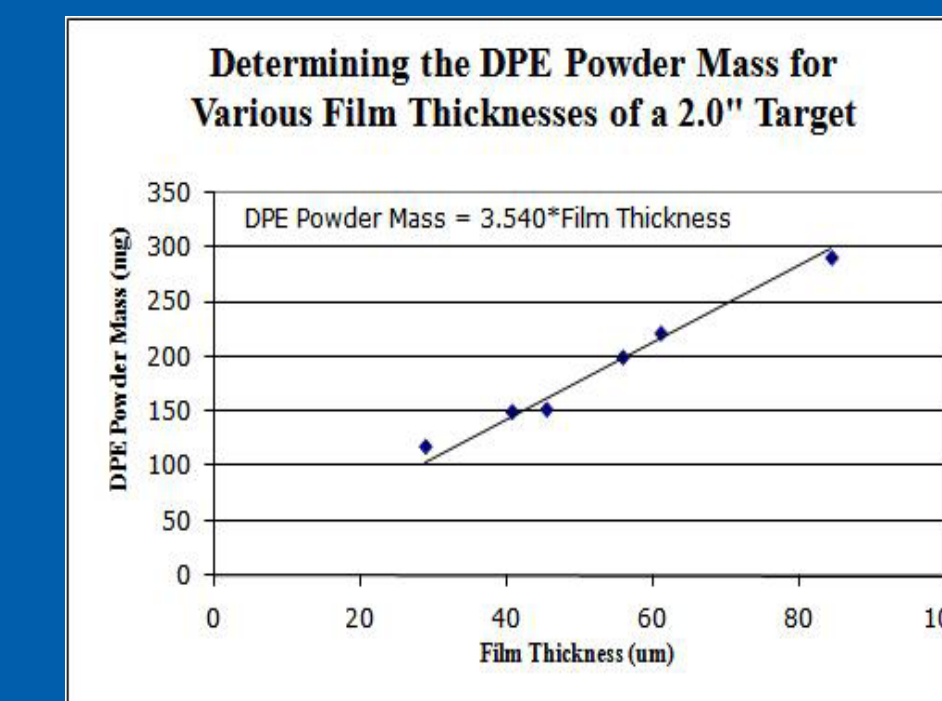
1) A tantalum substrate was secured between the top and base plate of the DPE film mold.



The threaded legs of the mold were installed and the mold was leveled.

2) In a vented fume hood a heated bath was filled with Convoil-20 Diffusion Pump oil, set to 120°C, and the mold was placed in the oil bath.

3) Appropriate amounts of DPE powder and xylene were poured in a beaker and placed on a 200°C hotplate. [See graph]

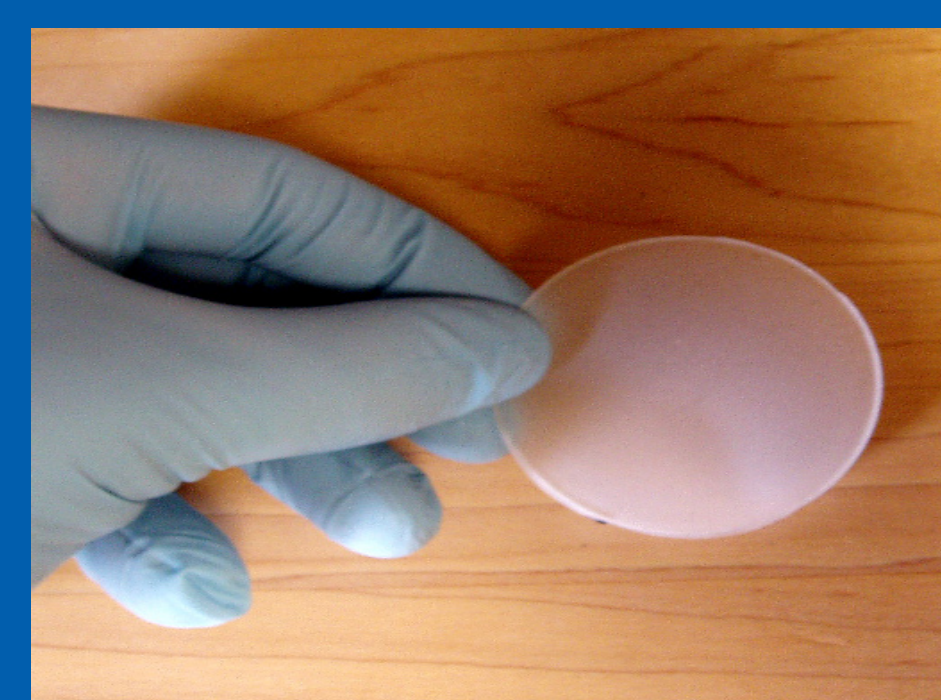


4) A watch glass was placed over the beaker to ensure evaporating xylene did not escape.



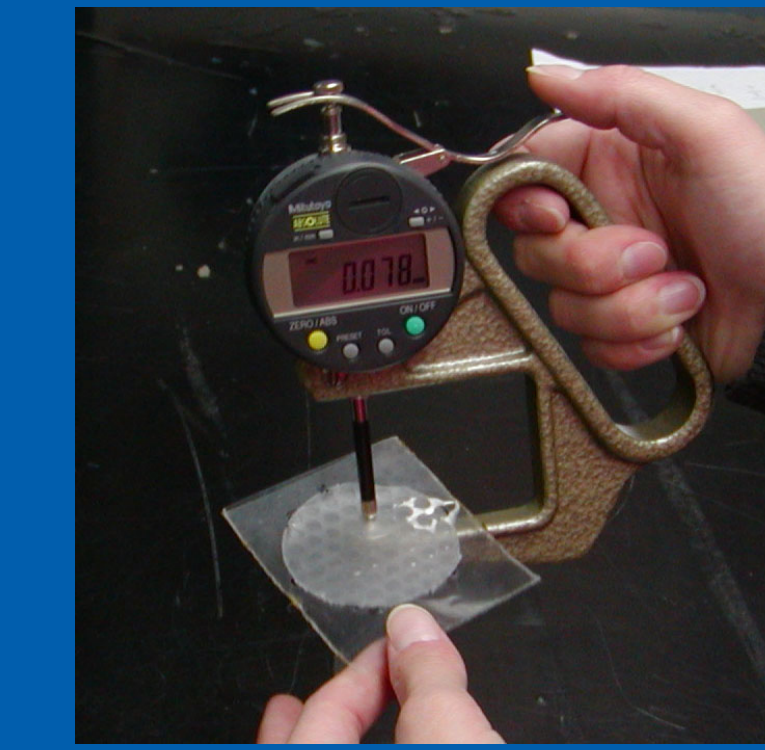
5) After the powder had dissolved, the solution was poured into the heated mold and an inverted watch glass was placed on top of the mold.

6) Once the xylene had evaporated the film became opaque and the mold was removed from the oil bath and allowed to cool at room temperature.

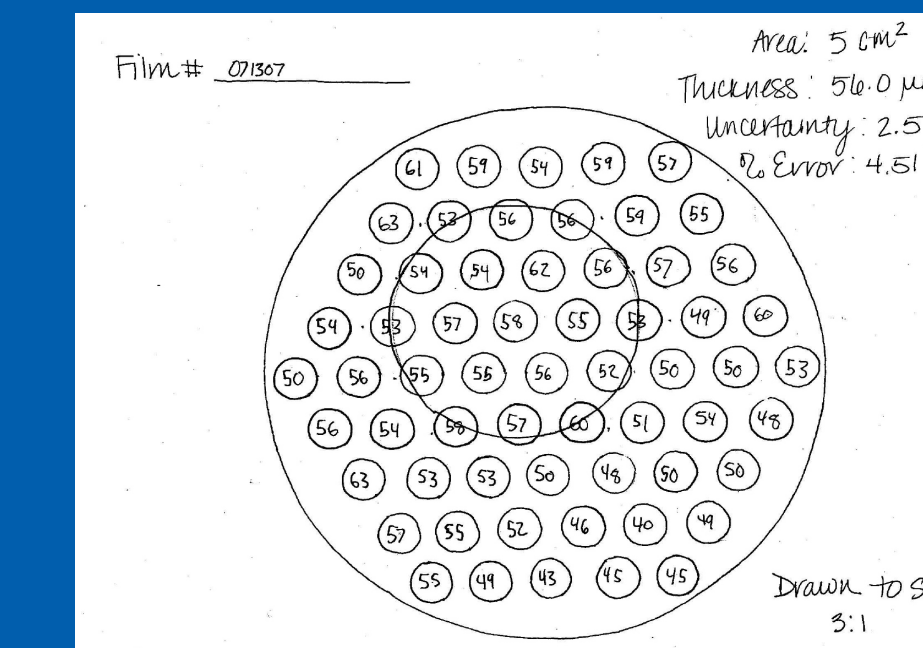


7) Once cooled the film was carefully removed from the tantalum.

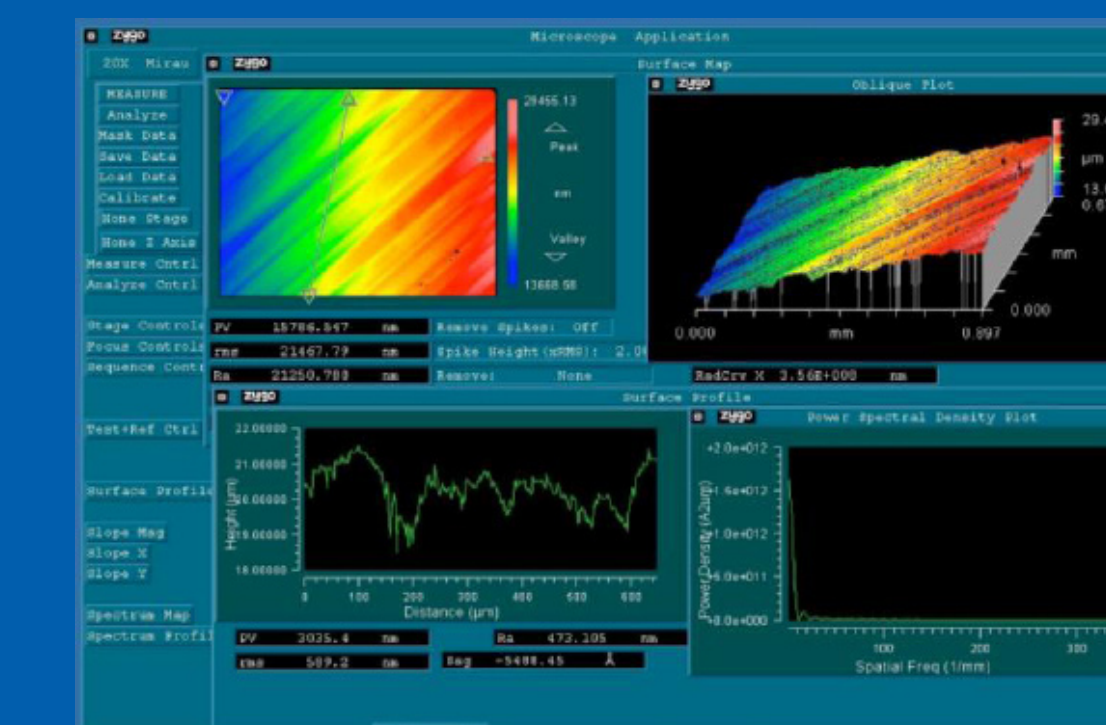
Results and Analysis



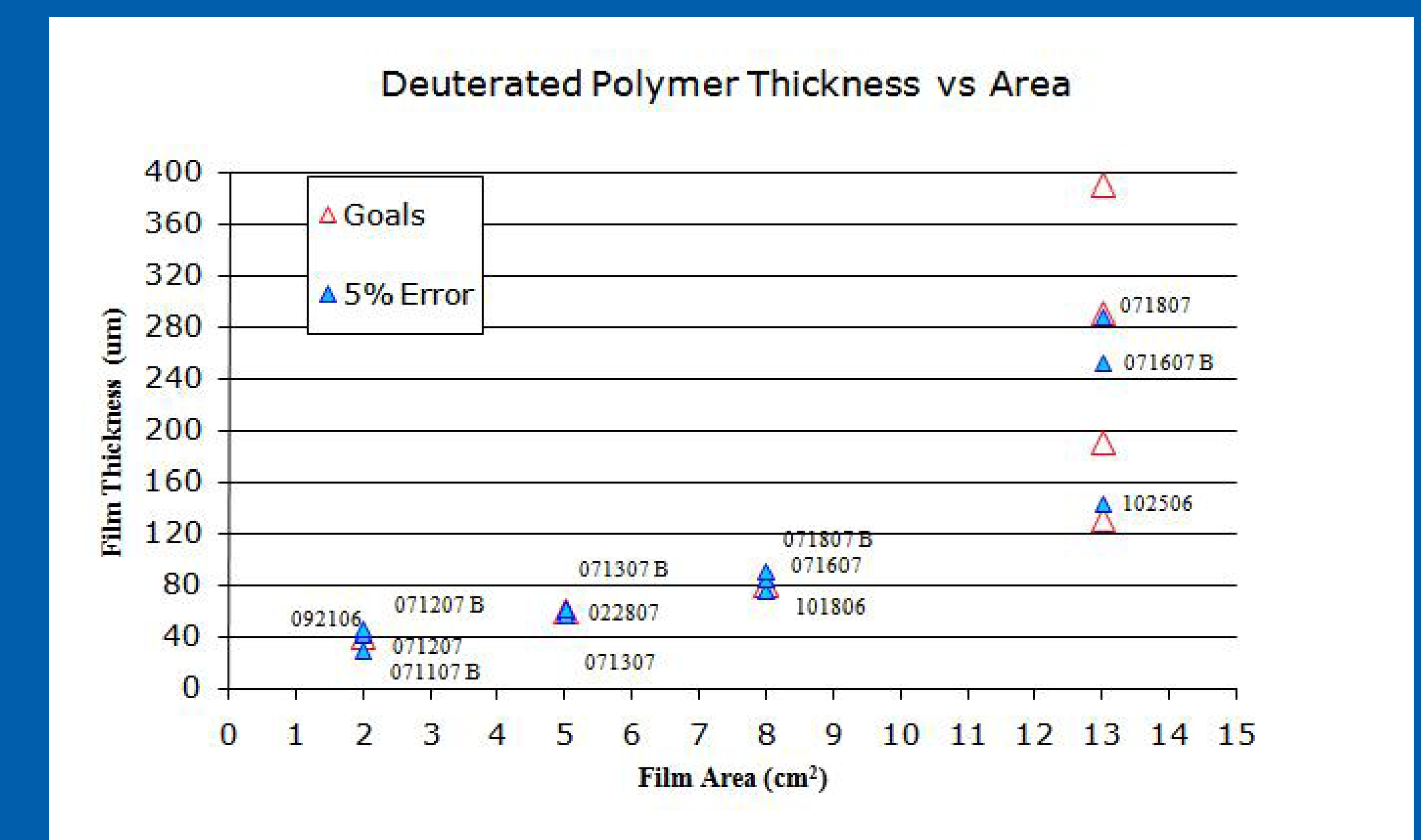
The film thicknesses were measured using a Dyer Series-309 thickness gauge. The gauge provided minimal contact force (~1 N) and a precision of about 1 μm.



Surface roughness measurements were made at LLE using a ZYGO optical interferometer system. Measurements of both sides of the film were made. The variation in the surface was determined to be about ±2 μm.



To date, numerous films have been fabricated meeting the required specifications.



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